Tennessee Science Curriculum Framework

Human Anatomy and Physiology

Course Description

Human Anatomy and Physiology is a laboratory science course that consists of an in-depth study of all of the body systems that maintain homeostasis from anatomical, physiological, and histological perspectives. Students explore the body through an inquiry approach.

Human Anatomy and Physiology students will study:

- Inquiry
- Technology and Engineering
- Anatomical Orientation
- Protection, Support, and Movement
- Integration and Regulation
- Transportation
- Absorption and Excretion
- Reproduction, Growth, and Development

Embedded Inquiry

Conceptual Strand

Understandings about scientific inquiry and the ability to conduct inquiry are essential for living in the 21st century.

Guiding Question

What tools, skills, knowledge, and dispositions are needed to conduct scientific inquiry?

Course Level Expectations

CLE 3251.Inq.1 Recognize that science is a progressive endeavor that reevaluates and extends what is already accepted.

CLE 3251.Inq.2 Design and conduct scientific investigations to explore new phenomena, verify previous results, test how well a theory predicts, and compare opposing theories.

CLE 3251.Inq.3 Use appropriate tools and technology to collect precise and accurate data.

CLE 3251.Inq.4 Apply qualitative and quantitative measures to analyze data and draw conclusions that are free of bias.

CLE 3251.Inq.5 Compare experimental evidence and conclusions with those drawn by others about the same testable question.

CLE 3251.Inq.6 Communicate and defend scientific findings.

Checks for Understanding (Formative/Summative Assessment)

- ✓**3251.Inq.1** Trace the historical development of a scientific principle or theory, such as the cell theory, evolution, or DNA structure.
- ✓**3251.Inq.2** Select a description or scenario that reevaluates and/or extends a scientific finding.
- ✓**3251.Inq.3** Conduct scientific investigations that include testable questions, verifiable hypotheses, and appropriate variables to explore new phenomena or verify the experimental results of others.
- ✓**3251.Inq.4** Select appropriate tools and technology to collect precise and accurate quantitative and qualitative data.
- ✓**3251.Inq.5** Evaluate the accuracy and precision of data.
- ✓**3251.Inq.6** Determine if data supports or contradicts a hypothesis or conclusion.
- ✓**3251.Inq.7** Compare or combine experimental evidence from two or more investigations
- ✓**3251.Inq.8** Recognize, analyze, and evaluate alternative explanations for the same set of observations.
- ✓**3251.Inq.9** Analyze experimental results and identify possible sources.
- ✓**3251.Inq.10** Compare conclusions that offer different, but acceptable explanations for the same set of experimental data.
- ✓**3251.Inq.11** Formulate and revise scientific explanations and models using logic and evidence.

Embedded Technology and Engineering

Conceptual Strand

Society benefits when engineers apply scientific discoveries to design materials and processes that develop into enabling technologies.

Guiding Question

How do science concepts, engineering skills, and applications of technology improve the quality of life?

Course Level Expectations

CLE 3251.T/E.1 Explore the impact of technology on social, political, and economic systems.

CLE 3251.T/E.2 Differentiate among elements of the engineering design cycle: design constraints, model building, testing, evaluating, modifying, and retesting.

CLE 3251.T/E.3 Explain the relationship between the properties of a material and the use of the material in the application of a technology.

CLE 3251.T/E.4 Describe the dynamic interplay among science, technology, and engineering within living, earth-space, and physical systems.

Checks for Understanding (Formative/Summative Assessment)

- ✓**3251.T/E.1** Distinguish among tools and procedures best suited to conduct a specified scientific inquiry.
- ✓**3251.T/E.2** Apply the engineering design process to construct a prototype that meets developmentally appropriate specifications.
- ✓**3251.T/E.3** Evaluate a protocol to determine the degree to which an engineering design process was successfully applied.
- ✓**3251.T/E.4** Explore how the unintended consequences of new technologies can impact human and non-human communities.
- ✓**3251.T/E.5** Evaluate the overall benefit to cost ratio of a new technology.
- ✓**3251.T/E.6** Present research on current bioengineering technologies that advance health and contribute to improvements in our daily lives.
- ✓**3251.T/E.7** Design a series of multi-view drawings that can be used by other students to construct an adaptive design and test its effectiveness.

Standard 1 – Anatomical Orientation

Conceptual Strand 1

Anatomy and physiology investigates the interdependence of structure and function to form a living, integrated whole.

Guiding Question 1

How is the body organized to function effectively and maintain homeostasis?

Course Level Expectations

CLE 3251.1.1 Distinguish between anatomy and physiology.

CLE 3251.1.2 Investigate the interrelationships between the structures and functions of the major body systems.

CLE 3251.1.3 Investigate the major body cavities, the subdivisions of each cavity, and the organs within each area.

CLE 3251.1.4 Use correct anatomical terminology when discussing body structures, sections, and regions.

CLE 3251.1.5 Describe the body mechanisms that maintain homeostasis.

Checks for Understanding (Formative/Summative Assessment)

- ✓**3251.1.1** Illustrate the interconnections between anatomy and physiology using a concept map.
- ✓**3251.1.2** Sequence the levels of structural organization from the molecular level through the organismic level.
- ✓**3251.1.3** Distinguish among the major types of tissues using laboratory investigations of prepared slides.
- ✓**3251.1.4** Classify organ systems of the body as either (1) protection, support, and movement, (2) regulation and integration (3) transport, and (4) absorption and excretion.

✓**3251.1.5** Identify the major organs and describe the functions of each body system

✓**3251.1.6** Identify and label the major body cavities including the subdivisions and organs of each.

✓**3251.1.7** Apply correct anatomical terminology when referring to body directional terms.

✓**3251.1.8** Illustrate examples of the body functions using homeostatic mechanisms**.**

✓**3251.1.9** Explain how the body regulates temperature, blood carbon dioxide levels, and blood glucose levels.

Standard 2 – Protection, Support, Movement

Conceptual Strand 2

The integumentary, skeletal, and muscular systems work together to support, protect, and move body structures as well as maintain homeostasis.

Guiding Question 2

How do body systems aid in support, protection, and movement as well as in maintaining homeostasis?

Course Level Expectations

CLE 3251.2.1 Identify the structures of the integumentary, skeletal, and muscular systems and show the relationship between these structures and their functions**.**

CLE 3251.2.2 Investigate the physiological mechanisms that allow the integumentary, skeletal, and muscular systems to carry out their functions.

Checks for Understanding (Formative/Summative Assessment)

✓**3251.2.1** Identify the structures of the skin and explain their role in protecting the body and maintaining homeostasis.

✓**3251.2.2** Explain the physiological processes involved in healing the skin and disorders of the skin.

✓**3251.2.3** Construct a model of the skin layers with the structures labeled and the functions described.

✓**3251.2.4** Identify and distinguish between the different types of bones.

✓**3251.2.5** Describe the physiological mechanisms involved in bone development, growth, and repair.

✓**3251.2.6** Identify the major muscles of the body.

✓**3251.2.7** Compare and contrast the axial and appendicular skeletons using a graphic organizer.

✓**3251.2.8** Observe, draw, and label the different types of muscle tissues noting their functions and structure.

✓**3251.2.9** Illustrate the major steps of the sliding filament theory of muscle contraction.

Standard 3 – Integration and Regulation

Conceptual Strand 3

The nervous and endocrine systems work in an integrative manner to maintain homeostasis and communicate with all other body systems.

Guiding Question 3

What external and internal bodily mechanisms are involved in communication, control, growth, and development?

Course Level Expectations

CLE 3251.3.1 Compare and contrast the anatomy and physiology of the central and peripheral nervous systems.

CLE 3251.3.2 Describe the structure, function, and developmental aspects of neurons and their supporting glial cells.

CLE 3251.3.3 Investigate the physiology of electrochemical impulses and neural integration.

CLE 3251.3.4 Investigate organs for perception of external stimuli and to the maintenance of homeostasis.

CLE 3251.3.5 Identify the major organs of the endocrine system and demonstrate the relationship of each organ to hormonal regulation.

Checks for Understanding (Formative/Summative Assessment)

✓**3251.3.1** Identify the major areas of the brain and the major structures of the spinal cord.

✓**3251.3.2** Identify the structure and function of cranial nerves, neurons, neuroglia, and neuromuscular junctions.

✓**3251.3.3** Use a graphic organizer to trace the pathway and biochemical changes associated with the conduction of an electrochemical impulse.

✓**3251.3.4** Construct a model to describe the molecular neurophysiology of membrane potentials in terms of electrolyte function and active transport.

✓**3251.3.5** Identify the structure and function of the parts of the sensory organs.

✓**3251.3.6** Differentiate among the major organs and tissues that comprise the endocrine system.

✓**3251.3.7** Explain how the hormones secreted by the endocrine system regulate the body.

✓**3251.3.8** Interpret graphs of blood sugar levels in terms of pancreatic function.

✓**3251.3.9** Analyze a case study of a neurological disorder and make a speculative diagnosis or prognosis.

Standard 4 – Transport

Conceptual Strand 4

The cardiovascular system transports materials pumped by the heart through blood vessels to all parts of the body. The lymphatic system bathes the body in extracellular fluid and works with the cardiovascular system to provide immunity and remove fats from digestion.

Guiding Question 4

How does the cardiovascular system transport substances that maintain homeostasis? What mechanisms are involved in staying healthy though the immune responses?

Course Level Expectations

CLE 3251.4.1 Identify the molecular and cellular components of the blood and the functions of the blood.

CLE 3251.4.2 Examine the anatomy of the heart and describe the pathway of blood through this organ.

CLE 3251.4.3 Describe the biochemical and physiological nature of heart function.

CLE 3251.4.4 Describe the relationship between the structure and function of different types of blood vessels.

CLE 3251.4.5 Describe the physiological basis of circulation and blood pressure.

CLE 3251.4.6 Identify the structure of the lymphatic system.

CLE 3251.4.7 Describe the details of the immune response.

Checks for Understanding (Formative/Summative Assessment)

✓**3251.4.1** Describe the types of blood vessels and name the major arteries and veins in the human body.

✓**3251.4.2** Identify the cellular components and physical characteristics of blood.

✓**3251.4.3** Identify the ABO blood types through experimentation.

✓**3251.4.4** Identify the layers, chambers, and valves of the heart.

✓**3251.4.5** Describe the biochemical and physiological events associated with heart contraction, blood pressure, and blood clotting.

✓**3251.4.6** Employ a variety of methods to measure blood pressure and the pulse.

✓**3251.4.7** Trace the pathway of blood through the heart and lungs.

✓**3251.4.8** Relate nonspecific cellular and chemical defenses of the body to factors

✓**3251.4.9** Compare the molecular affinity of hemoglobin to oxygen and carbon monoxide in terms of maintaining homeostasis.

✓**3251.4.10** Describe the immune response mechanisms at the cellular level.

✓**3251.4.11** Identify the causes of imbalances in the immune system.

Standard 5 – Absorption and Excretion

Conceptual Strand 5

The digestive system takes in food and changes it to a usable form. The urinary system removes wastes and maintains osmotic balance.

Guiding Question 5

How does the digestive system convert food into the raw materials that build and fuel the body's cells? How does the urinary system maintain the homeostatic balance of internal fluids?

Course Level Expectations

CLE 3251.5.1 Identify the organs of the digestive and urinary systems and explain their function.

CLE 3251.5.2 Describe the mechanisms of digestion and food absorption.

CLE 3251.5.3 Explain how nutrition, metabolism, and body temperature are related.

CLE 3251.5.4 Explain how kidneys function to remove wastes from the blood.

Check for Understanding (Formative/Summative Assessment)

✓**3251.5.1** Compare the structure and function of organs of the digestive system.

✓**3251.5.2** Trace a selected food through the digestive tract, identifying the biochemical reactions and enzymes that facilitate digestion.

✓**3251.5.3** Contrast mechanical and chemical digestion.

✓**3251.5.4** Identify how enzymes produced by the organs or glands of the digestive system act on food.

✓**3251.5.5** Explain how the products of digestion are absorbed.

✓**3251.5.6** Compare and contrast the male and female urinary systems.

✓**3251.5.7** Explain how the kidneys act to maintain homeostasis.

✓**3251.5.8** Describe the composition of normal urine.

✓**3251.5.9** Identify the parts of a nephron and describe how they assist in urine formation.

✓**3251.5.10** Describe a countercurrent mechanism and explain how it helps concentrate urine.

✓**3251.5.11** Discuss the importance of water and electrolyte balance.

✓**3251.5.12** Describe how body temperature is regulated.

Standard 6 – Reproduction, Growth, and Development

Conceptual Strand 6

The reproductive system ensures continuity of the species.

Guiding Question 6

How do the organs and structures of the reproductive system function to produce successive generations of offspring?

Course Level Expectations

CLE 3251.6.1 Identify the essential and accessory organs of the male and female reproductive systems and give the generalized function of each.

CLE 3251.6.2 Explain how hormones regulate a typical 28-day menstrual cycle.

CLE 3251.6.3 Summarize the principal events that occur during prenatal development.

Check for Understanding (Formative/Summative Assessment)

✓**3251.6.1** Relate the structures of the male and female reproductive systems to their functions.

✓**3251.6.2** Describe the role of hormones in controlling the secondary sex characteristics.

✓**3251.6.3** Compare and contrast the processes and products of oogenesis and spermatogenesis.

✓**3251.6.4** Trace the pathway that sperm travel from the testes to the exterior of the body.

✓**3251.6.5** Summarize the events of the menstrual cycle.

✓**3251.6.6** Describe the feedback control mechanisms for hormones that regulate the menstrual cycle.

✓**3251.6.7** Sequence the stages of human development from gametogenesis to birth.

✓**3251.6.8** Describe the major functions of the placenta.

✓**3251.6.9** Research and describe methods of controlling human fertility, and describe their mechanisms and relative effectiveness.